

**Title: METHOD AND SYSTEM FOR CREATING A
CONVENIENTLY ACCESSIBLE PORTABLE MEDICAL
HISTORY**

5

FIELD OF THE INVENTION

This invention relates to the field of personal medical information management, and in particular, to the field of computerized personal medical information management.

10

BACKGROUND OF THE INVENTION

A medical emergency can happen to anyone. Unfortunately, there is today a wide variety of potential causes for medical emergencies. For example, as the population ages, heart disease is increasing, and accompanying this rise in heart disease is an overall increase in the incidence of acute heart attack. Statistics show that heart disease is the number one killer of people in the United States. Heart disease and acute heart attack lead to millions of hospital emergency room visits and physician office visits each year. In the emergency room setting, the quality of treatment for acute heart attack is significantly increased if the caregiver has access to relevant medical information such as the patient's most current electrocardiogram, his current medications and his medical history.

15

Other medical conditions that could lead to emergency situations include allergies, epilepsy, diabetes, and adverse drug reactions. In each case, the effectiveness of treatment would be increased by knowledge of what medications the patient may be taking, the results of tests that the patient may have recently undergone, or the patient's medical history.

20

Even in non-emergency situations, it is frequently important for a treating physician to know facts from the patient's medical history. While the patient's regular physician will usually have access to most such data,

25

30

EL&13909009US

this may not be the case when the patient is being treated by a physician other than his regular physician, such as, for example, a specialist.

In the event that information on a patient's medical background is required, the attending caregiver has the option of attempting to contact the patient's regular doctor, or health maintenance organization (HMO), in order to obtain the necessary information. However, this procedure suffers from some important defects. First, particularly in emergency situations, time is of the essence. Attempts to reach third parties to obtain relevant information can be time consuming, and the information may come too late to help the patient.

Second, there is no guarantee that the attending caregiver will even know who the patient's regular doctor is, or where to obtain the patient's medical history. After all, the patient may be unconscious, or otherwise unable to communicate.

Third, there are significant concerns relating to patient confidentiality in any system where an attending caregiver simply calls the patient's regular caregiver or HMO to obtain information. Under such a system, any person can contact a doctor or HMO, pretending that there is an emergency in progress and that the medical records of a certain patient are required. To remedy this it might be possible to implement some kind of password system which would require the HMO or regular doctor to be given a password prior to the release of medical information. However, in an emergency situation, the patient may not be able to communicate what his password is and the attending caregiver may not have any other way of knowing what the password is.

Fourth, it is possible that the patient's medical history is not centralized, so that some aspects of the medical history would be stored with one doctor, specialist or organization, and some aspects with others. Thus, in an emergency, the attending caregiver may actually need to phone around to a number of different locations to obtain the required information. This would be unacceptable, particularly in an emergency situation.

U.S. Patent Number 5,832,488 issued to Eberhardt, discloses a method for storing medical records. The records are entered on a PC and stored on a 3.5 inch diskette. If the file is too large for such a diskette, it is stored in a larger remote data storage computer. The method includes

5 having the patient's regular health care provider input medical information using software installed on the PC, which is then stored either on the diskette, or on the remote computer.

This method has a number of problems. First, the emergency caregiver likely may not have available the type of software necessary to

10 read the medical history saved on the disk. Thus, although the disk can be carried by the patient, it may not, in practice, provide any information to the emergency caregiver.

Second, if the medical history is too large and needs to be stored at least in part on the remote data storage computer, this would

15 require an emergency caregiver to contact the remote computer. This would probably need to be done via modem, either through a dedicated phone line, a dial-up connection, or the Internet. Dedicated phone lines can be expensive for the emergency caregiver. Furthermore, the caregiver may not be in a location where he/she has access to the dedicated line. This could

20 happen, for example, with paramedics handling an emergency in a remote area where no telephone contact is possible.

With respect to dial-up connections, sometimes the connection is down, and sometimes the number of dial-ups exceeds the capacity of the relevant system, resulting in a busy signal. As for the internet, an internet

25 connection is often very slow, or temporarily down. Thus, relying on the internet or on a dial-up connection for instant access to medical history information in an emergency is not acceptable.

Third, this system requires the regular health care provider to install new software on its computers whose function it is to create the

30 medical records. This necessitates the hiring of technical support personnel, which is costly. It would also use up valuable memory on the health care provider's computer, which could possibly be put to better uses.

SUMMARY OF THE INVENTION

Therefore, what is desired is a method of creating a medical history which does not require the installation of the medical-history-creating
5 software on the computers of the regular health care provider, who is initially in possession of the medical history information. This method will also be useable to create a medical history that is portable by the patient, and thus readily available to an emergency caregiver, without requiring access to a remote source to obtain the medical history. Preferably, the method will
10 create a medical history that will be easily accessible by technology that is widely available, and is thus likely to be available to an emergency caregiver. It will also preferably be a method which creates a complete medical history that is quickly readable by an emergency caregiver.

Thus, according to one aspect of the invention, there is
15 provided a method of creating a conveniently accessible medical history for a patient, the method comprising the steps of:

- 1) establishing an information-transmission connection with a remote information-input node;
- 2) receiving medical information through said information-transmission connection from said information-input node;
- 20 3) configuring said information into a medical history record, which medical history record is storable on a portable readable storage medium; and
- 4) transmitting said medical history record to a remote record
25 output node, said record output node being configured to store said medical history record on said portable readable storage medium;

whereby a conveniently accessible medical history can be created by storing said medical history record on said portable readable storage medium.

30 According to another aspect of the invention, there is provided a method of creating a conveniently accessible medical history for a patient, said method comprising the steps of:

1) establishing an information-transmission connection with a remote record-creating node;

2) transmitting medical information through said information-transmission connection to said record-creating node, said record-creating node being adapted to configure said information into a medical history record, said medical history record being storable on a portable readable storage medium;

3) receiving said medical history record from said record-creating node;

4) storing said medical history record on said portable readable storage medium.

According to a still further aspect of the invention, there is provided a system for creating a conveniently accessible medical history for a patient, said system comprising:

an information-input node for receiving medical information and transmitting said information through an information-transmission connection;

a record-creating node, remote from said information-input node, for receiving said information through said information-transmission connection, for configuring said information into a medical history record, and for transmitting said medical history record;

a record output node, remote from said record-creating node, for receiving said medical history record from said record-creating node and for storing said medical history record on a portable readable storage medium.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made by way of example only to drawings of the present invention which illustrate the preferred embodiment of the invention, and in which:

Figure 1 is a schematic diagram of the system for creating a conveniently accessible medical history according to the present invention; and

Figure 2 is an alternative schematic diagram of the system for creating a conveniently accessible medical history according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figure 1, there is shown the preferred embodiment of a system for creating a conveniently-accessible medical history. The system includes an information input node 10, connected to a record creating node 12 by an information transmission connection 18. The record creating node 12 is connected to a record output node 14, which is in turn connected to a portable readable storage medium 16 for storing medical history records.

Generally, the method for creating a conveniently accessible medical history comprises establishing an information-transmission connection 18 between the information input node 10 and the record creating node 12. Medical information is sent from the information input node 10, through the information transmission connection 18, and received by the record creating node 12. The record creating node 12 is adapted to configure the medical information into a medical history record which is storable on a portable readable storage medium. The medical history record is then transmitted by the record creating node 12 and received by the record output node 14. The record output node 14 is configured to store the medical history record on a portable readable storage medium 16. This method is described in greater detail below.

To create a conveniently-accessible medical history, it is necessary to have access to the medical history of the relevant patient. Typically, the medical records of patients will be located at places such as health maintenance organizations (HMOs), doctors' offices, medical clinics or insurance companies (hereinafter referred to generally as "health

Medical history information can be inputted into the information input node 10 in a variety of ways. Most preferably, the health organization will have patient medical records in electronic form in a storage computer 20, which, for the purposes of this specification, includes any storage media (such as tapes or disks or any other medium) on which the health organization stores raw medical history information in electronic format. This is most likely in cases where the health organization is an HMO. Because HMOs have enormous amounts of medical data from a large number of patients, they are most likely to have invested in storing the data electronically in a storage computer 20. It is most preferable for the patient records to be in electronic form because that obviates the need to input manually the raw medical history information of the patient.

It will be appreciated that the required translation software 22 may need to be customized for each health organization, since each health organization may electronically store its raw medical history information in a different format. The creation of customized translation software 22 is a significant cost for the health organization, as it requires employing people to develop the software. Thus, the use of translation software 22 would

likely be cost effective in situations where the health organization is storing a large amount of raw medical history information, and is likely to create a large number of conveniently accessible medical histories using the same translation software 22. In such a case, creating customized translation
5 software 22 would be less costly than inputting raw medical history information by hand.

It will also be appreciated that translation software 22 would not be needed if the raw medical history information is stored by the health organization in a format compatible with the record creating node 12.
10 Preferably, the record creating node 12 will be configured to be compatible with open data format standards such as HL7, ODBC (Open Database Connectivity), XML or HTML. In such a case, if the raw medical history information is stored electronically at the health organization in one of these formats, translation software 22 will not be necessary for translating the raw
15 information from one data format to another.

The raw medical history information will sometimes not be stored in electronic format. Instead, the raw medical history data may be stored on paper. So, for example, the records showing relevant data such as the patient's allergies, past illnesses and current medical conditions might
20 be in type-written or hand-written form on papers contained in the patient's file. In such a case, it might be necessary for this data to be entered manually into the information input node 10 at the health organization.

It will be appreciated that if the raw medical history data is in written form, it will be necessary to manually input the raw data in a manner
25 that makes it compatible with the record creating node 12. In such a case, the information input node 10 would include a PC/user interface 24 and a keyboard 26 connected thereto. The text portion of the raw medical history information could be manually inputted into the PC/user interface 24 through the keyboard 26. The PC/user interface 24 comprises a PC, preferably with
30 a user interface installed thereon. The user interface is preferably simple software, installable on most PCs, which prompts the user to enter the

relevant raw medical history information, and stores the entered medical history in a format compatible with the record creating node 12.

It will be appreciated that, in the case where textual medical history information is manually inputted, other configurations besides the PC/user interface 24 might be used to manually input the information. For example, a user interface might be used which is stored at the record creating node 12, and the manual inputting could be done by establishing the information transmission connection 18 and using the PC as a terminal. What is important is that, in the case where textual medical history information is to be inputted manually, the information input node 10 and the record creating node 12 be configured to allow for such manual inputting.

Other relevant patient information includes the results of tests, such as electrocardiograms or various blood work tests. These types of test results are typically shown in graph or chart form, rather than in textual or written form. To be of maximum use to a subsequent caregiver, the entire image is preferably provided. Thus, for this type of medical history information, it is useful to ensure that the entire image (for example, of an electrocardiogram) is available in the medical history record being created.

If the images are stored electronically, they will preferably be dealt with as generally described above with respect to raw medical history data which is stored by the health organization in electronic form. If the images are not in suitable electronic form, the images will need to be inputted and transmitted to the record creating node 12 in order to be included in the medical history record. In such a case, the information input node 10 may include either a fax machine 28 or a scanner 30, or both, which devices can be used to translate medical images into a digital format which allows the record creating node 12 to place these images into the medical history record. As shown in Figure 1, if a scanner 30 and keyboard 26 are both used, the scanner 30 is preferably connected to the PC/user interface 24. In this way, the user interface can also be used to receive images digitized by the scanner 30.

The information transmission connection 18 links the information input node 10 and the record creating node 12. Medical history information for use in creating a conveniently-accessible medical history, which information may include information entered by hand into the information input node 10, information stored in electronic format, and images, is transmitted via the information transmission connection 18 to the record creating node 12.

Preferably, the information transmission connection 18 comprises an internet connection 32. In other words, the medical information (though not necessarily all of the information) travelling from the information input node 10 to the record creating node 12 will travel via the internet connection 32. This use of the internet is preferred for a number of reasons. First, use of the internet for creating the information transmission connection 18 and transmitting information from the information input node 10 to the record creating node 12 allows for maximum flexibility in the location of the record creating node 12. Given that internet connections 32 are so easily and widely available, the record creating node 12 can be located virtually anywhere. Second, an internet connection is significantly less expensive than, say, a dedicated phone line or a dial-up connection to the record creating node 12.

It will be appreciated that making the information transmission connection 18 a dedicated phone line, or even a dial-up connection, would be more reliable than using the internet connection 32. In other words, an internet connection is likely to be down or slow more often than a dedicated phone line, where the reliability of the connection is extremely high. However, it is believed that reliability of connection is less important than the benefits arising from the use of the internet. The reason for this is that, when the medical history record is being created, there is no emergency situation. Rather, the creation of the record is an administrative task undertaken by the health organization. The task is not undertaken in response to an emergency, and thus there is likely to be no harm to a patient resulting from a slower internet connection, or resulting from the need to wait

[illegible][illegible][illegible]

Table 1

Variable	Mean	Standard deviation	Minimum	Maximum
Age	60.78	9.12	45	75
Gender	Male = 1 Female = 2	1.00	1	2
Marital status	Married = 1 Single = 2 Divorced = 3	1.00	1	3
Educational level	High school or less = 1 Bachelor's degree = 2 Master's degree = 3 Doctorate = 4	1.00	1	4
Employment status	Full-time = 1 Part-time = 2 Unemployed = 3	1.00	1	3
Income	\$10,000-\$19,999 = 1 \$20,000-\$29,999 = 2 \$30,000-\$39,999 = 3 \$40,000-\$49,999 = 4 \$50,000-\$59,999 = 5 \$60,000-\$69,999 = 6 \$70,000-\$79,999 = 7 \$80,000-\$89,999 = 8 \$90,000-\$99,999 = 9 \$100,000+ = 10	1.00	1	10
Health status	Excellent = 1 Very good = 2 Good = 3 Fair = 4 Poor = 5	1.00	1	5
Exercise frequency	Never = 1 Once a week = 2 Twice a week = 3 Three times a week = 4 Four times a week = 5 Five times a week = 6 Six times a week = 7 Seven times a week = 8 Eight times a week = 9 Nine times a week = 10 Ten times a week = 11	1.00	1	11
Exercise intensity	Light = 1 Moderate = 2 Vigorous = 3	1.00	1	3
Social support	No support = 1 Low support = 2 Medium support = 3 High support = 4	1.00	1	4
Lifestyle factors	Smoking = 1 Alcohol consumption = 2 Dietary habits = 3 Stress management = 4	1.00	1	4

[illegible]

personnel necessary to create medical history records. By this model, health organizations would simply be able to use the resources of the ASP's record creating node 12, rather than having to provide their own resources to provide this service. For this reason, the ASP model is more efficient.

5 Because the same ASP can provide the same record creating services for use by a variety of different health organizations, the ASP will have the advantage of high volume. As a result, it will have the advantage of a relatively low cost for creating each medical history record. By contrast, not having the advantage of high volume, it would cost an individual health
10 organization more to create each medical history record if it created the records on its own without using the ASP. Thus, the health organizations for whom each medical history record is created will have the option of passing the cost (i.e. the price charged to them by the ASP) on to their patients.

 Various modes of pricing are available to the ASP. For
15 example, a health organization that frequently uses the ASP could be offered a bulk subscription rate for the record creating node's services. Alternatively, the ASP could charge the health organization a single low price per record created.

 Such a system of a flat fee per record created would allow the
20 health organization to easily make a specified level of profit per record created. So, for example, if the ASP charges the health organization five dollars (\$5) per record created, the ASP can simply charge the patient ten dollars (\$10) per record created, thus turning the record creation into a profit centre for the health organization, in addition to allowing the health
25 organization to pass on the cost of creating the medical history records.

 This can be accomplished without complex information or accounting requirements, since all that is required is to multiply the ASP's price charged to the health organization by a specified multiplier to determine what the health organization's price to the customer or patient will
30 be. Also, notably, the ASP will be able to establish this profit centre without investing in the computing resources necessary to create medical history records, the software necessary to do so, and the support personnel that

095571.080901
T06090 T/552560

that have been diagnosed; the date that the conditions began; any diagnoses of past conditions; any past surgeries; emergency contact names; the particulars of how and where to reach those contacts; the name and particulars of the patient's primary care physician; a full personal profile of the patient, including a full physical description, religion, employment, marital status, insurance particulars, whether a smoker, family medical history, blood type, age and sex; the results of tests, including haematology and biochemistry test results, diagnostic image reports (e.g. CT scans, nuclear medicine, x-ray, ultrasound and MRI), electrocardiograms, echocardiograms, stress tests, coronary angiographies, catheterization reports and holter monitoring reports; the patient's immunization history, transplant history, and a full record of any implantable devices (e.g. pacemaker) that have been implanted in the patient; and a photograph of the patient, which adds a further check for insuring that the medical history record really belongs to the person carrying it.

In the preferred embodiment, the record creating computer 36 is coupled to a health information database (HID) 50. The HID 50 will contain information on various different medical conditions, including information related to symptoms, treatment, nutrition, surgery and management of the condition.

In creating the medical history record, the record creating computer 36 will preferably read the medical history information to ascertain what conditions the patient suffers from, is predisposed to, or is at risk from. The computer 36 will then extract from the HID 50 information relating to these medical conditions and include such information in the medical history record.

In the preferred embodiment, the medical condition information will be linked to the statement of the condition itself within the medical history record. So, for example, if the patient has asthma, the word "asthma" would appear in the medical history record. The patient would be able to click on the word "asthma" and be linked to medical condition information on asthma.

The same would be true for other conditions that the patient has, is at risk from, or is predisposed to.

After the medical history record is created within the record creating node 12, it is transmitted to a record output node 14. The record
5 output node 14 is configured to store the medical history record, which has just been created in the record creating node 12, on the portable readable storage medium 16. It will be appreciated that the medical history record is preferably transmitted via the internet, which, as stated above, provides an inexpensive and flexible way of transmitting the medical history record to the
10 record output node 14.

It will be appreciated that the record output node 14 and the information input node 10 may include a single computer at the premises of the health organization. This configuration is shown in Figure 2, with like elements being designated by the same reference numerals as in Figure 1.
15 Conceptually, the record output node 14 includes, at least, the software and hardware which is needed to store the medical history record on the portable readable storage medium 16. Thus, for example, the record output node 14 may include the PC in the PC/user interface 24. In this case, the PC/user interface would include the software and hardware which is needed to store
20 the medical history record on the portable readable storage medium 16, such as, preferably, a compact disk read/write device.

Alternatively, as shown in Figure 1, the record output node 14 may comprise an output computer 40, which is separate from the PC/user interface 24, connected to a compact disk read/write device 42.

Thus, it will be appreciated that, when reference is made to a
25 record output node 14 and to an information input node 10, these two elements may be associated with the same computers and hardware (such as the PC/user interface), or with separate computers and hardware (as shown in Figure 1). What is important is that the functions of information
30 input node 10 and of the record creating node 14 are performed in creating the conveniently accessible medical history.

history record might be accessed from a remote location, confidentiality would require the use of some kind of password. However, in an emergency situation, the patient might not be able to provide that password. According to the present invention, the medical history record is preferably carried on
5 the person of the patient. Thus, there little risk that the medical history record will be accessed without the permission and knowledge of the patient, unless the patient is unconscious, ill or injured, in which case the emergency medical workers will simply access the record being carried by the patient. That is the purpose of having the patient carry the medical history record.
10 Since the medical record is being carried on the person of the patient, it is not available to be accessed for inappropriate reasons (absent loss or theft), and thus no password is generally required.

The medical history record created in the record creating node 12 is preferably represented in either HTML or XML. A record in HTML
15 would be readable by any ordinary internet browser software, and newer internet browsers will be able to utilize XML. Most personal computers are sold with internet browser software, such as Microsoft's Internet Explorer, or Netscape's internet browser. Thus, if the medical history record is represented in HTML or XML, it is likely that any computers used by
20 emergency medical personnel will be able to read the medical history record, without requiring any additional software, thus saving expense and facilitating use of the medical history record.

It will be appreciated that, if XML is used, it may be possible for a hospital to upload the medical history record from the compact disk
25 directly into the hospital's electronic medical record. Specifically, this would be possible if the hospital's electronic medical record is itself represented in XML. Thus, a patient arriving at the emergency room of the hospital can have his medical history record directly uploaded into the hospital computer, thus reducing the amount of paperwork and data entry needed at the
30 hospital.

It will also be appreciated, however, that the medical history record need not necessarily be represented in HTML or XML. Rather the

medical history record may be in any format that allows it to be read by a subsequent caregiver.

Thus, in the preferred embodiment where the portable readable storage medium 16 is a compact disk, the record output node 14 will preferably include a computer 40 which is connected to a compact disk read-write device 42. It is in this way that the record output node 14 stores the medical history record on the portable readable storage medium 16, which is preferably a compact disk.

As one of the purposes of the medical history record is to allow for emergency medical personnel to have access to the medical history of a patient, it is important that the medical history record be accurate. Thus, it is preferable that provision be made for the medical history record to be inspected after being created in the record creating node 12, but before being stored by the record output node 14 on the portable readable storage medium 16. Thus, preferably, the record output node 14, and more specifically, the output computer 40, is configured so as to allow the medical history record to be displayed and inspected, preferably by a medical professional, prior to being saved on the portable readable storage medium 16.

The use of the internet in the preferred embodiment to transmit medical history information from the information input node 10 to the record creating node 12, and from the record creating node 12 to the record output node 14 raises confidentiality concerns. The internet is generally not secure, and information transmissions over the internet can be intercepted. Thus, it is preferable that information transmitted from the information input node 10 and from the record creating node 12 be encrypted. Most preferably, the encryption technology used will be PKI encryption.

Also, the encryption will preferably be 128-bit encryption. Presently, technology for conducting secure 128-bit encrypted communication over the Internet is easily available commercially, but still provides a level of encryption which is difficult to defeat.

Thus, the record creating node 12 is preferably configured to encrypt the medical history record prior to transmitting it to the record output node 14, and the record output node 14 is adapted to decrypt the medical history record. Also, the information input node 10 preferably is configured to encrypt medical history information being sent over the information transmission connection 18, and the record creating node 12 is preferably configured to decrypt information coming over the information transmission connection 18.

In the preferred embodiment, the raw medical history information is encrypted at the information input node 10 using the ASP's public key and decrypted by the ASP using its private key. The raw medical history information is then configured into a medical history record at the record creating node 12. Then, the medical history record is encrypted using the health organization's public key. One copy is transmitted to the record output node 14 and decrypted by the health organization's private key. Another is retained in encrypted form on the ASP server. This allows the health organization to update the medical history record at any time by simply sending the new raw medical history information to be incorporated. However, because the retained copy is encrypted, the ASP cannot access the data without first having it decrypted by the health organization.

While the foregoing embodiments of the present invention have been set forth in detail for the purposes of making complete disclosure of the invention, it will be apparent to those skilled in the art that various modifications can be made to the invention without departing from the scope of the invention as defined in the attached claims. Some of these variations are discussed above and others will be apparent to those skilled in the art. For example, the medical history record may be represented in any format that can be read by a subsequent caregiver such that the caregiver has access to the medical history record. What is important is that the medical history be conveniently accessible so as to improve the care given to the patient.